

What is claimed is:

1. A liquid dispensing apparatus comprising:  
a dispensing mechanism including a dispensing device for dripping a  
sample or a reagent;  
5 an image capturing device for capturing the downward area image;  
a movable table capable of supporting, on its upper surface, a target  
object onto which the sample or reagent is to be dispensed and being moved on  
a horizontal plane surface for positioning the target object at least at a  
dispensing position beneath the dispensing device and at an image capturing  
10 position beneath the image capturing device;  
a monitoring section for displaying the image captured by the image  
capturing device;  
a dispensing position designating section for designating the dispensing  
position on the target object based on the image of the target object displayed  
15 on the monitoring section; and  
a dispensing control section for positioning the target object and the  
dispensing device relative to each other so that the dispensing position on the  
target object designated by the dispensing position designating section is placed  
beneath the dispensing device of the dispensing mechanism and for controlling  
20 the dispensing operation of the dispensing mechanism.
2. A liquid dispensing apparatus according to claim 1, wherein the  
dispensing mechanism includes a plurality of dispensing devices.
- 25 3. A liquid dispensing apparatus according to claims 1 or 2, further  
comprising a dispensing position information creating section for creating  
dispensing position information about the dispensing position on the target  
object which is designated by the dispensing position designating section and for  
which the dispensing operation has been performed.  
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4. A liquid dispensing apparatus according to any one of claims 1 to 3,  
wherein the dispensing position information creating section is capable of

outputting the created dispensing position information to the outside.

5        5. A liquid dispensing apparatus according to any one of claims 1 to 4,  
wherein the dispensing position designating section designates the dispensing  
position on the image of the target object displayed on the monitoring section.

10        6. A liquid dispensing apparatus according to claim 1, further  
comprising an image capturing device for photographing the tip end of the  
dispensing device.

15        7. A liquid dispensing apparatus according to claim 2, further  
comprising an image capturing device for photographing the tip end of the  
dispensing device performing the dispensing operation, out of the dispensing  
devices, wherein the image capturing device is supported on a moving  
mechanism so that it is capable of being moved in association with the  
switching of the dispensing device performing the dispensing operation.

20        8. A dispensing apparatus comprising:  
a dispensing mechanism including a detachable dispensing device for  
dripping a sample or reagent;  
an image capturing device for capturing downward area image;  
a movable table capable of supporting, on its upper surface, a target  
object onto which the sample or reagent is to be dispensed and being moved on  
a horizontal plane surface for positioning the target object at least at a  
25        dispensing position beneath the dispensing device and at an image capturing  
position beneath the image capturing device; and  
a calibrating section which, after liquid is dispensed onto a  
predetermined position on the movable table by the dispensing mechanism,  
detects the dispensing position based on the image captured by the image  
30        capturing device and calibrates the dispensing position based on base points  
serving as references on the movable table, the base points being captured  
concurrently with the image.

9. A liquid dispensing apparatus according to claim 8, wherein the dispensing mechanism includes a plurality of dispensing devices and the calibrating section performs the calibration for the respective dispensing  
5 devices.

10. A position information capturing device comprising:  
an image capturing device for capturing an image of a target object on a  
table; and

10 a position information creating section for creating, based on the image captured by the image capturing device, information about a position designated or detected in the image, based on a plurality of reference points serving as references on the target object.

15 11. A position information capturing device according to claim 10, further comprising:

a monitoring section for displaying the image captured by the image capturing device; and

20 a position designating section for designating a position on the target object based on the image of the target object displayed on the monitoring section;

wherein the position information creating section creates information about the position on the target object designated by the position designating section.

25 12. A position information capturing device according to claims 10 or 11, wherein

the image capturing device also captures an image of the table along with the image of the target object; and

30 the position information creating section creates a position on the target object based on a plurality of base points serving as references on the table.

13. A position information capturing device according to any one of claims 10 to 12, wherein the dispensing position information creating section is capable of outputting the created dispensing position information to the outside.

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14. A sample plate comprising:

a plate-shaped member having a surface onto which a sample or reagent is to be dispensed,

the plate-shaped member being provided with, on the surface, a plurality of marks serving as positional references.

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15. A dispensing apparatus comprising:

a dispensing mechanism including a nozzle for dripping a sample or a reagent;

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a movable table capable of supporting, on its upper surface, a target object onto which the sample or reagent is to be dispensed and being moved on a horizontal plane surface for positioning the target object beneath the nozzle; and

an image capturing device placed on a plane surface, within the range of movement of the movable table and mounted at a position above the movable table for preventing contact therewith, wherein the image capturing device photographs the tip end of the nozzle at an angle from above.

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16. A dispensing apparatus according to claim 15, wherein a light source is placed at the position opposite to the image capturing device with respect to the tip end of the nozzle and the light source is oriented in such a direction that light emitted from it is reflected at the surface of the target object, then passes through the tip end of the nozzle and enters the image capturing device.

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17. A dispensing apparatus according to claims 15 or 16, wherein the image capturing device photographs the shape of a liquid drop formed at the tip

end of the nozzle as the image of the nozzle tip end.

18. A dispensing apparatus according to any one of claims 15 to 17,  
wherein the image capturing device is set to capture an image of the surface of  
5 the target object beneath the nozzle along with the image of the tip end of the  
nozzle.

19. A monitoring method comprising:  
installing an image capturing device obliquely above a nozzle for dripping  
10 a sample or a reagent; and  
photographing, with the image capturing device, the condition of a liquid  
drop dripped from the nozzle for monitoring the condition of dispensation.

20. A dispensing method using a dispensing unit; the dispensing unit  
15 comprising a piezo chip having a downward opening portion at its discharging  
portion and being configured to discharge liquid drops from the discharging  
portion when liquid charged in a space communicated to the discharging portion  
is pushed by a driving section including a piezo device, a pressure control  
mechanism for adjusting the pressure of the liquid charged in the space, and an  
20 image capturing device for capturing an image of the discharging portion, the  
method comprising the steps of:

capturing and storing an image of the discharging portion before  
charging liquid in the space by the image capturing device;

after charging liquid in the space, capturing images of the discharging  
25 portion by the image capturing device, determining the differences between  
these images and the image captured before charging liquid and controlling the  
pressure control mechanism so that, when liquid exits from the discharging  
portion, the liquid is retracted until the differences between these images and  
the image captured before charging liquid is cancelled, in a preparation stage  
30 before the start of dispensation operation from the piezo chip.

21. A dispensing method according to claim 20, wherein the control of

the pressure control mechanism is automatically performed based on images captured by the image capturing device.

22. A dispensing apparatus comprising:

- 5       a dispensing unit including a piezo chip having a downward opening portion at its discharging portion, the piezo chip being configured to discharge liquid from the discharging portion when liquid charged in a space communicated to the discharging portion is pushed by a driving section including a piezo device, a pressure control mechanism for adjusting the pressure of the liquid
- 10      charged in the space;
- an image capturing device for capturing an image of the discharging portion;
- a storing device for storing the image captured by the image capturing device; and
- 15       a control device which compares the image of the discharging portion captured before charging liquid in the space and stored in the storing device with images captured after charging liquid in the space and controls the pressure control mechanism so that, when liquid exits from the discharging portion, the liquid is retracted until the differences between the images and the
- 20      image captured before charging liquid is cancelled.

23. A dispensing apparatus according to claim 22, wherein the image capturing device is installed so that it captures the image of the discharging portion along a horizontal direction.

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24. A dispensing method utilizing a dispensing unit for discharging liquid drops from a discharging portion at its tip end; the method comprising the steps of:

- 30       acquiring an image of a liquid drop discharged from the discharging portion;
- determining the size of the liquid drop based on the captured image; and
- adjusting parameters of control signals output to a discharging driving

section of the dispensing unit, based on the determined size of the liquid drop, so that the amount of dispensed liquid drop becomes equal to a predetermined value.

5           25. A dispensing method according to claim 24, wherein the dispensing unit utilizes a piezo-dispensing system including a piezo head and the piezo head is configured to discharge the liquid drop from the discharging portion when liquid charged in a space communicated to the discharging portion at its tip end is pushed by a driving section including a piezo device.

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26. A dispensing method according to claim 25, wherein the parameters of control signals include at least one of: the amplitude of the voltage applied to the piezo device, the rising time of the applied voltage, the voltage application time period, and the descending time of the applied voltage.

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27. A dispensing method according to claim 24, wherein the dispensing unit utilizes a syringe-pump dispensing system.

28. A dispensing method according to claim 27, wherein the  
20 parameters of control signals include at least one of: the stroke, the speed and the acceleration of the plunger of the syringe pump.

29. A dispensing method according to claims 27 or 28, wherein the  
25 image for determining the size of the liquid drop are an image of ball-shaped liquid drop at the tip end of the discharging portion.